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WO 2001/030600 A1 US 6059019 A

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F4U UA  
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ONLINE DATABASES: WPI, EPODOC, JAPIO.

(54) Abstract Title

Heat exchanger

(57) A number of motor vehicle heat exchangers 12, 14, 16 are assembled together before being mounted as one unit into a motor vehicle. The heat exchangers are combined by carrier units 20, 22 on opposite sides of the heat exchangers. These carrier units engage with the heat exchanger on the two opposing sides and hold the heat exchanger together as a group, whilst also carrying the necessary features to enable the assembly to be mounted in a vehicle.

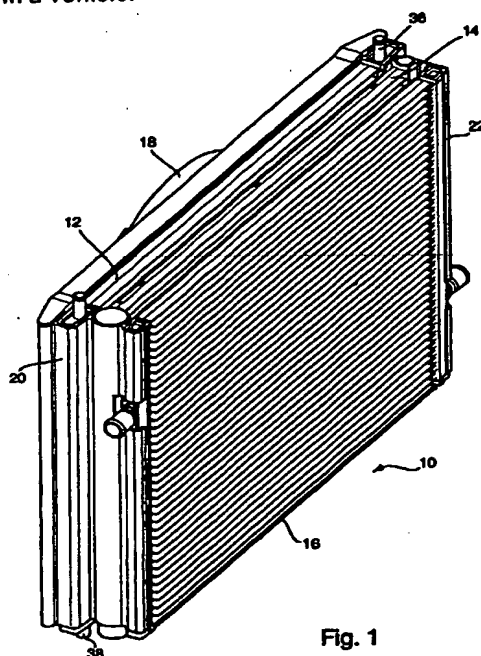


Fig. 1

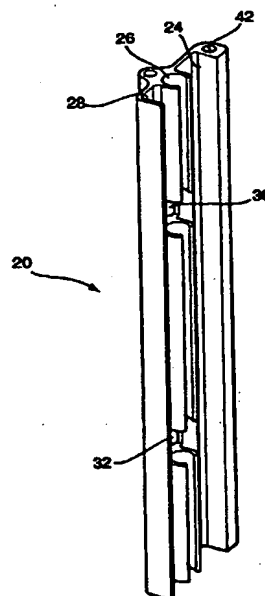


Fig. 3

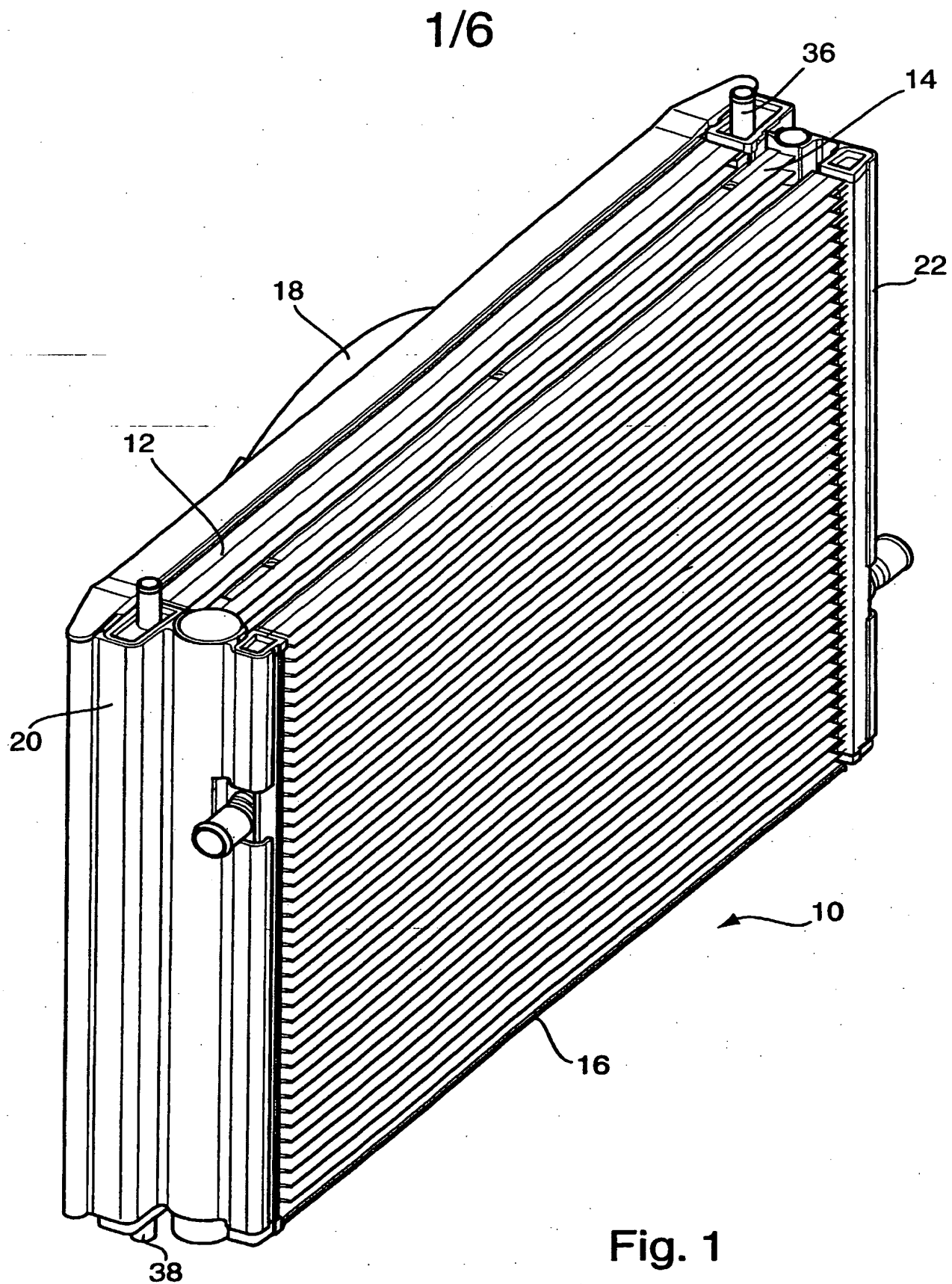


Fig. 1

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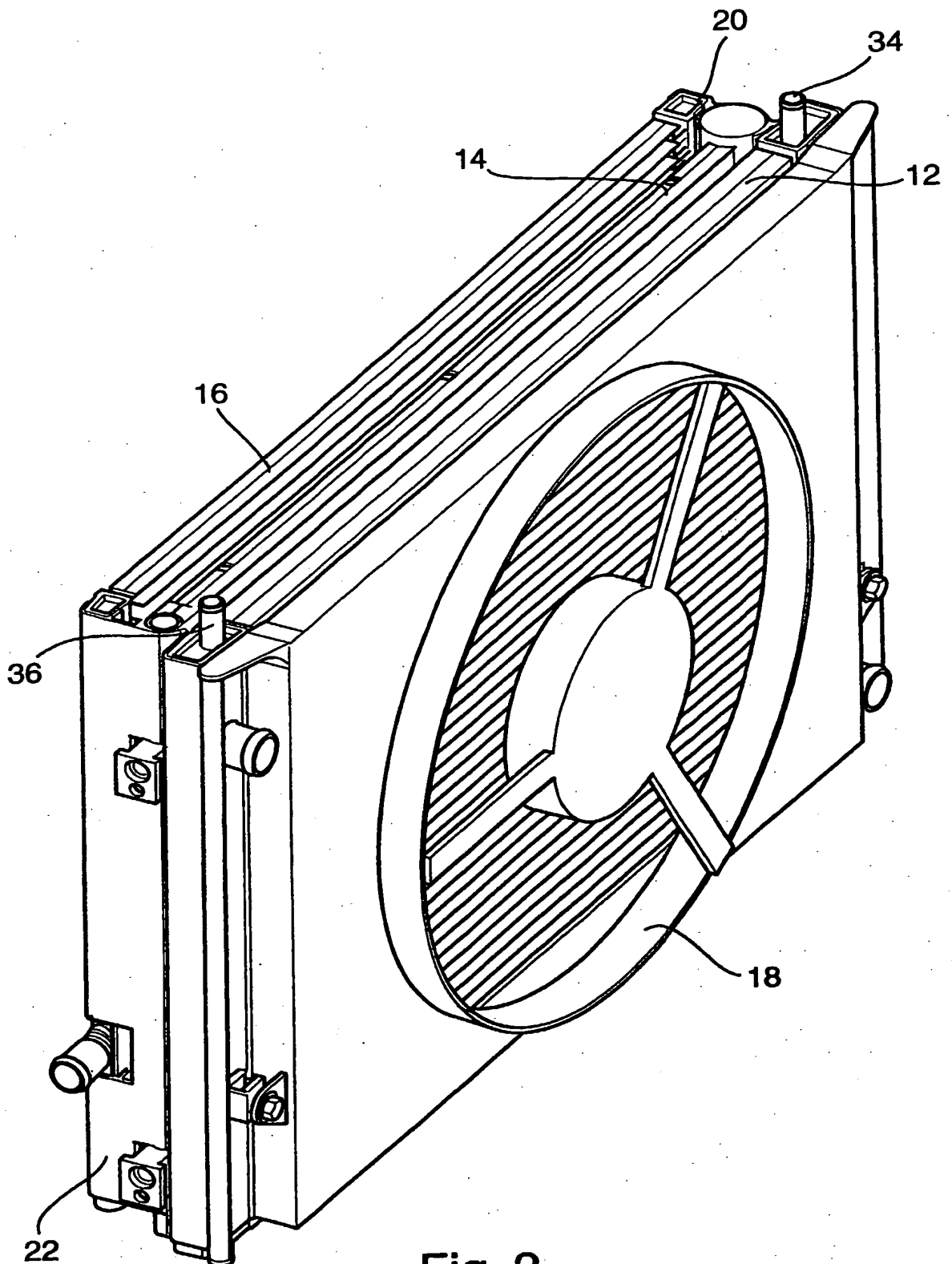


Fig. 2

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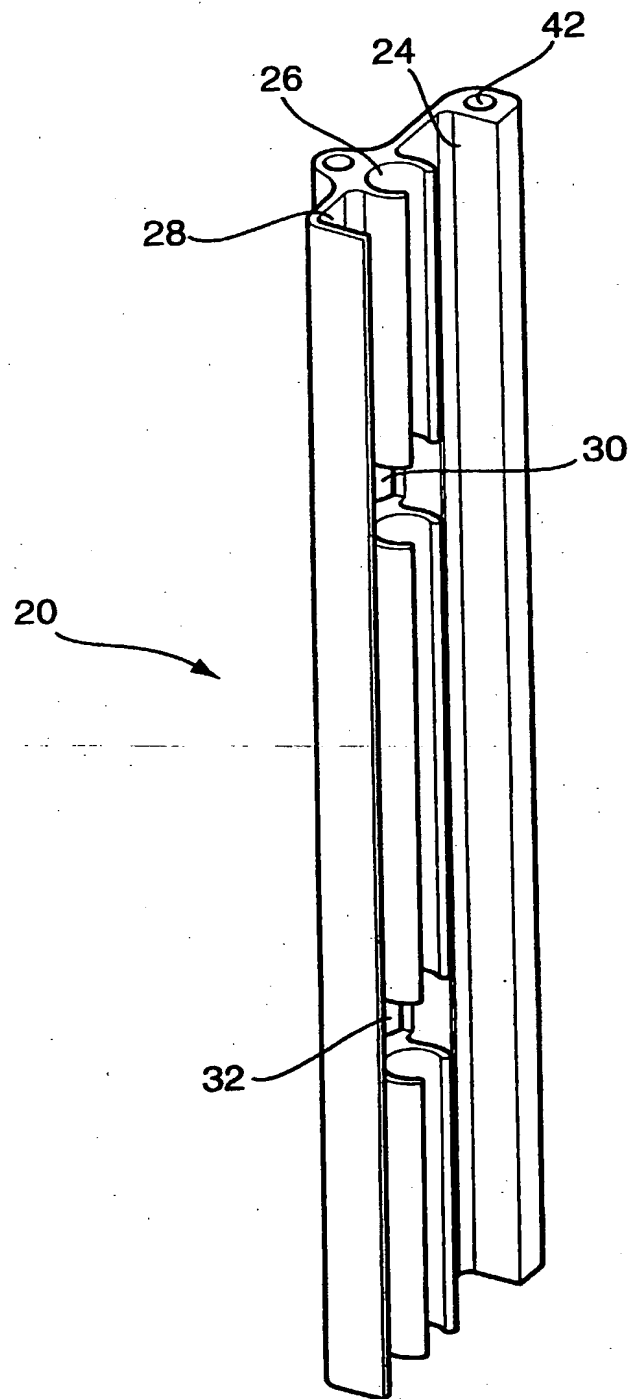


Fig. 3

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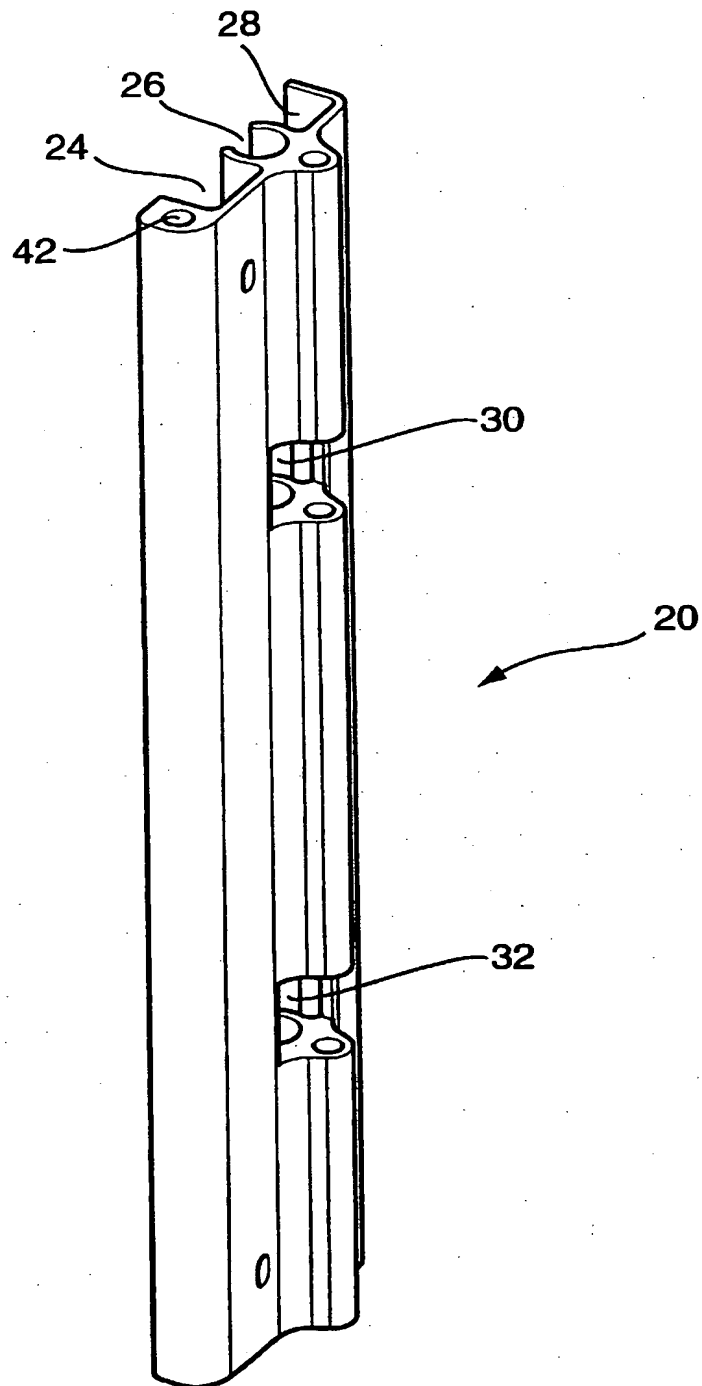


Fig. 4

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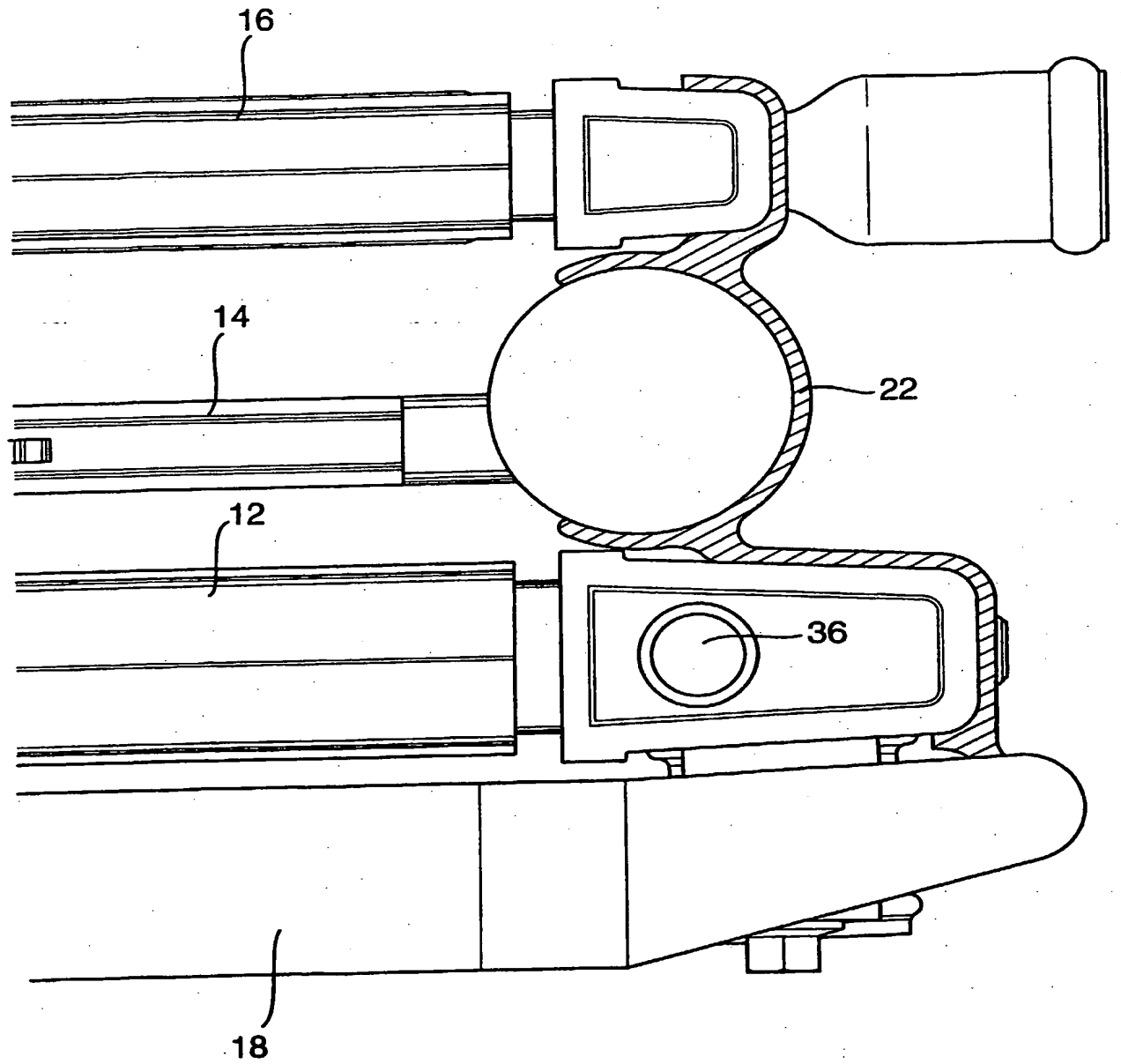


Fig. 5

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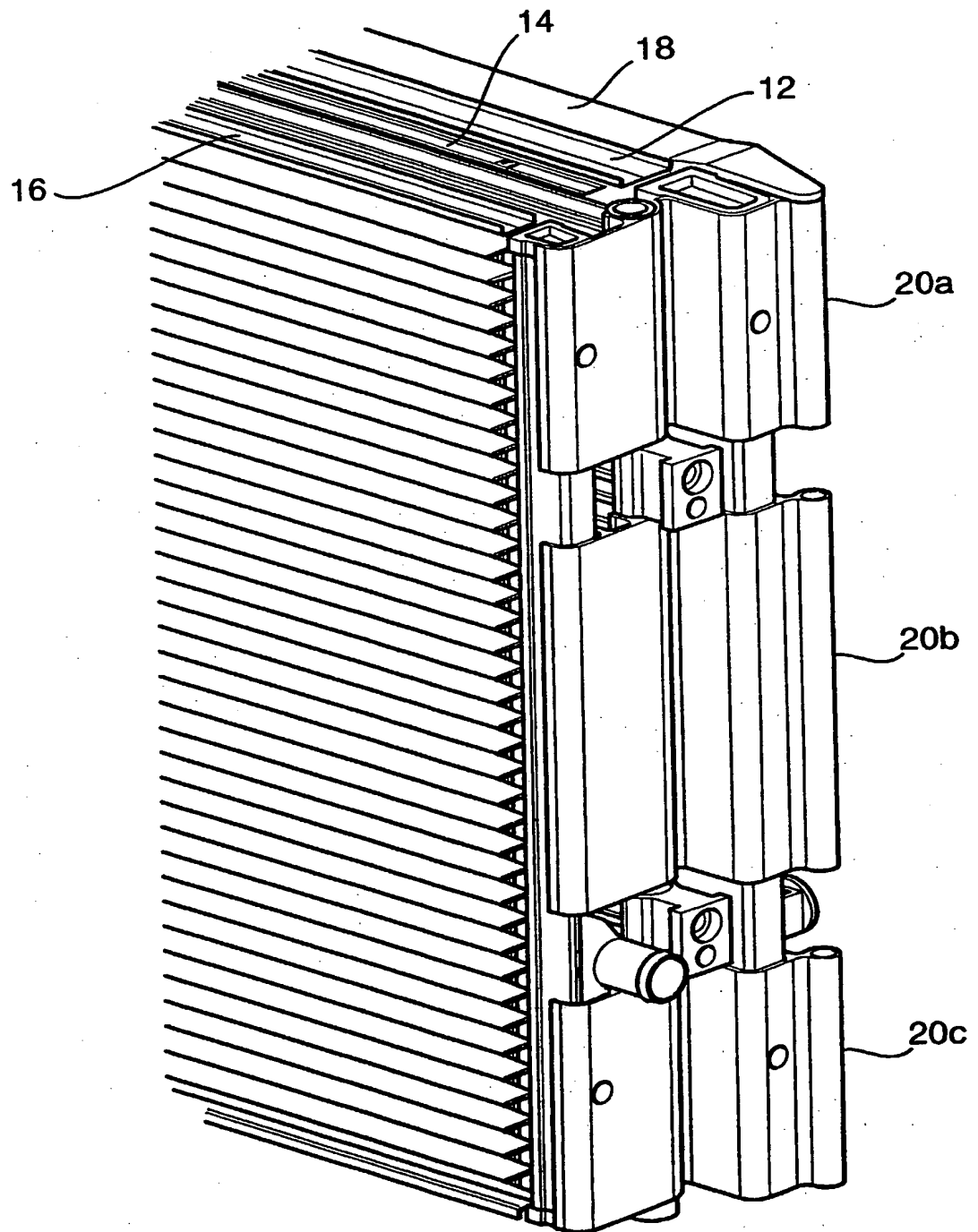


Fig. 6

## Heat Exchanger

This invention relates to a modular heat exchanger assembly, for use in motor vehicles where several heat exchangers are to be mounted in the same vehicle. For  
5 example, a vehicle specification may require various combinations of:

- an engine cooling radiator
- an air-conditioning condenser
- 10 • a transmission oil cooler
- an intercooler for cooling intake gases.

Conventionally, each heat exchanger unit has been individually mounted on mounting points in the vehicle.  
15 This requires a set of mounting points for each unit and an assembly process for each unit.

Motor vehicle heat exchangers conventionally have a fin and tube core mounted between header tanks (these header  
20 tanks are sometimes called manifolds).

According to the invention, there is provided a modular heat exchanger assembly wherein a plurality of heat exchangers, each with metal header tanks, are combined  
25 into a single assembly with the aid of two carrier units, mounted at opposite sides of the assembly and receiving the header tanks of each heat exchanger in respective guide tracks, and wherein the carrier units include means for mounting the assembly in a vehicle.

30 This modular assembly can be built off-line, and then assembled into the vehicle body in a single operation. The necessary fluid connections must be made individually to each heat exchanger, but only one set of mechanical



connections has to be made to support all the heat exchangers in the vehicle.

5 Using this carrier unit to connect the heat exchangers allows the heat exchanger to be correctly placed relative to one another to optimise their performance. There should be no significant heat transfer between the exchangers.

10 There is an increasing trend in motor vehicle design to manufacture heat exchangers from aluminium. This has advantages of low weight, but also allows easy recycling, as the entire heat exchanger can be recycled without first needing to separate components made of different materials. It is preferred for the carrier units also to  
15 be of aluminium, so that the entire assembly can be recycled in one piece.

20 However it is a disadvantage of aluminium header tanks that it is difficult to form them with requisite mounting points by which the heat exchanger can be installed in a vehicle. Conventional plastics header tanks do not have this disadvantage. The carrier units could be made of plastics moulded so that the carrier units provide the necessary mounting points. The plastics used will not be  
25 highly stressed and do not require high performance characteristics. Recycled plastics may be appropriate.

The carrier units can each be a single component (possibly with subsidiary components attached to it) or can each  
30 comprise more than one component. In its simplest form, the carrier units could be clips fastened between the heat exchangers and connected (in use) to the vehicle structure.

If the carrier units are unitary, they will provide a side seal to stop air escaping around the edges of the heat exchanger, instead of flowing through the heat exchanger core.

5

Preferably the heat exchangers are all designed with vertically extending header tanks at their opposite lateral edges, so that the assembly will be installed in the vehicle with the carrier units mounted vertically.

10

The carrier units may be extruded sections, with separate tracks formed in the sections to receive the heat exchanger header tanks. The heat exchangers may be a push fit in the tracks or may be positively secured to the carrier plates. Alternatively the carrier units could be moulded, of metal or plastic, or could be made up of a number of components, each of which is likely to be a plastics moulding. In the case of a plastics moulding, it is desirable that the connection with the heat exchanger should be a push fit so that the mouldings can be easily detached from the heat exchanger for servicing\replacement and/or for recycling.

15

20

It will be apparent that all the heat exchangers in the assembly should have their header tanks on the same edges of the exchangers. It is convenient if all the heat exchangers are approximately the same width, but this is not essential, as the carrier units can be constructed to accommodate simultaneously heat exchangers of different width.

25

30

The carrier units can also support a cooling fan and the associated fan shroud, in their correct positions relative to the heat exchangers so that air from the fan passes through the heat exchangers.

35

The carrier unit mounting points preferably include rubber or the like isolators which isolate the assembly from undue vibration.

5

The invention will now be further described, by way of example, with reference to the accompanying drawings, in which:

10        Figure 1 is a perspective view, from in front, of a heat exchanger assembly in accordance with the invention;

15        Figure 2 is a perspective view, from behind of the heat exchanger of Figure 1;

Figure 3 is a view from one side of a carrier plate in accordance with the invention;

20        Figure 4 is a view, from an opposite side, of the carrier plate of Figure 3;

25        Figure 5 is a top view of one end of the assembly of Figures 1 and 2, showing the engagement of the heat exchangers in the carrier plate; and

30        Figure 6 is a view from one end of part of a heat exchanger showing a second embodiment of the invention.

Figure 1 shows an assembly 10 comprising three side-by-side heat exchangers. These heat exchangers are: an engine coolant radiator 12, an air-conditioning condenser

14 and an oil cooler 16. At the back of the assembly (see particularly Figure 2) a cooling fan shroud 18 is mounted.

The heat exchangers are held together in a single assembly by two carrier plates 20 and 22. These plates are fitted at each end of the assembly and each one receives the header tanks of all the heat exchangers, through a push fit engagement.

Figures 3 and 4 show a typical form of these carrier plates. Ideally, both plates 20 and 22 will have the same cross-section, but it is within the scope of the invention for them to have different cross-sections. The plate shown in Figures 3 and 4 has a track 24 to receive an end tank of the radiator 12, a track 26 to receive an end tank of the condenser 14 and a track 28 to receive an end tank of the oil cooler 16. The plate also has apertures 30, 32 through the wall to allow the passage of fluid connections to and from the end tanks.

It will be seen from Figures 3 and 4 that the carrier plates have a uniform cross-section, and are therefore very suitable for manufacture by an extrusion method. The plates may be of metal (preferably aluminium) or of plastics. For some applications it may be more advantageous to manufacture the carrier plates using a moulding process.

If the carrier plates 20, 22 are extrusions, the same extrusion may be used at both ends of the assembly. In this case, openings such as 30 and 32 may be in different places in the two plates.

The dimensions of the tracks 24, 26, 28 will be such that the carrier plates can push fit on or snap on to the

respective header tanks. In particular, the track 26 which is to receive the header tank of the air-conditioning condenser 14 is shown as having a C-shaped cross-section to snap on to the circular section header tank of the condenser (see particularly Figure 5).

In any particular heat exchanger assembly, not all of the tracks 24, 26, 28 may be filled. Of course the carrier plates may have more or less than the three tracks shown in the Figures.

To prepare the assembly, the heat exchangers are placed side by side, and the carrier plates are fitted onto the end of all the exchangers. The assembly can then be installed in a vehicle, and mounting pins 34, 36 will be inserted in corresponding mounting sockets on the vehicle structure. Rubber isolator bushes will be mounted on the pins before the pins are inserted in the sockets. There will be top and bottom mounting points. If these are all pins, the assembly may be introduced into the vehicle structure prior to the positioning of a cross member. If the assembly is introduced from below (with pins 34, 36 fitting into holes in the underside of an upper cross member) then the installation will be completed by inserting the bottom pins 38, 40 into sockets in a lower cross member, prior to the connection of the lower cross member to the vehicle structure.

Once this installation has been completed, the carrier units will be locked in position relative to the heat exchangers.

The carrier unit can have other features incorporated into it, for example there can be sockets 42 into which pegs

moulded into the ends of the fan shroud can be fitted to hold the fan shroud in place.

Figure 6 shows an embodiment in which the carrier unit 20 is divided into three separate sections 20a, 20b and 20d. Dividing the sections in this way makes it possible for the fluid connections to the heat exchangers (eg 44,45,46) to exit from the assembly without any need to specially form the plates 20,22. The sections can cover the major part of the vertical edges of the assembly, or can cover a less than the major part.

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Claims

1. A modular heat exchanger assembly wherein a plurality of heat exchangers, each with metal header tanks, are  
5 combined into a single assembly with the aid of two carrier units, mounted at opposite sides of the assembly and receiving the header tanks of each heat exchanger in respective guide tracks, and wherein the carrier units include means for mounting the assembly in a vehicle.  
10
2. An assembly as claimed in Claim 1, wherein the heat exchangers, including the fin and tube core and the header tanks, are made from aluminium.
- 15 3. An assembly as claimed in Claim 1 or Claim 2, wherein the carrier units are of aluminium.
4. An assembly as claimed in Claim 1 or Claim 2, wherein the carrier units are made of a plastics material moulded  
20 so that the carrier units provide the necessary mounting points.
5. An assembly as claimed in any preceding claim, wherein the carrier units are each formed substantially as  
25 a single component.
6. An assembly as claimed in any one of Claims 1 to 4, wherein the carrier units each comprise more than one component.  
30
7. An assembly as claimed in any preceding claim, wherein the heat exchangers are all designed with vertically extending header tanks at their opposite lateral edges, so that the assembly will be installed in  
35 the vehicle with the carrier units mounted vertically.

8. An assembly as claimed in any preceding claim,  
wherein the carrier units are extruded sections, with  
separate tracks formed in the sections to receive the heat  
5 exchanger header tanks.
9. An assembly as claimed in any preceding claim,  
wherein the heat exchangers are a push fit in the tracks.
- 10 10. An assembly as claimed in any one of Claims 1 to 8,  
wherein the heat exchangers are positively secured to the  
carrier units.
- 15 11. An assembly as claimed in any preceding claim,  
wherein the carrier units support a cooling fan and the  
associated fan shroud, in their correct positions relative  
to the heat exchangers so that air from the fan passes  
through the heat exchangers.
- 20 12. An assembly as claimed in any preceding claim,  
wherein the carrier unit mounting points include rubber or  
the like isolators which, in use, isolate the assembly  
from undue vibration.
- 25 13. A set of carrier units for use as part of the  
assembly of any preceding claim.
- 30 14. A modular heat exchanger assembly substantially as  
herein described with reference to the accompanying  
drawings.





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Application No: GB 0107332.9  
Claims searched: All

Examiner: Mark Lewney  
Date of search: 24 August 2001

## Patents Act 1977 Search Report under Section 17

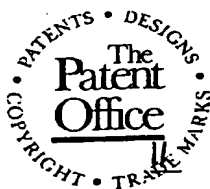
### Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:  
UK CI (Ed.S): B7H (HNS), F4S (S42J, S42K, S7, S8) F4U (UA).  
Int CI (Ed.7): B60H (1/00), B60K (11/04), F28D (1/04), F28F (9/00), (9/007).  
Other: Online databases: WPI, EPODOC, JAPIO.

### Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
XE	WO01/30600A1 (DENSO CORPORATION) - See especially fig. 6. Vehicle-mounted structure of heat exchanger comprising guide channel (121) for radiator or condenser (200).	1, 5, 7, 9 at least.
X	EP1024045A2 (VALEO INC.) - See figs. 1 and 2. Support bracket (2) for a heat exchanger (50), a condenser (60) and a fan shroud (40) having guide tracks (6, 8, 16).	1, 4, 5, 7, 9-12.
Y	GB2355700A (CATERPILLAR INC) - Heat exchanger assembly mounted on a slide mechanism. Could be combined with any document having two heat exchangers mounted adjacently (eg. doc. 4) to form obviousness objection.	1 at least.
Y	US6059019 (MODLINE MANUFACTURING CO.) - Heat exchanger assembly comprising radiator (22) releasably mounted adjacent to a condenser (24). Could be combined with slide mechanism of doc. 3 to form obviousness objection.	1 at least.

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.



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Application No: GB 0107332.9  
Claims searched: All

Examiner: Mark Lewney  
Date of search: 24 August 2001

Category	Identity of document and relevant passage	Relevant to claims
A	GB2262600A (BEHR GMBH & CO.) - Modular unit with multiple heat exchangers mounted adjacent to one another.	
A	GB2118709A (SUDDEUTSCHE) - Heat exchanger having supporting fins (22) with a member (8) which slidably engages with a guide groove (5).	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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